4.4 Diversion

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Definition

A ridge of compacted soil, constructed above, across, or below a slope.

Purpose

Diversions are used to reduce slope lengths and intercept and divert storm runoff to a stable outlet at a non-erosive velocity.

Conditions

The use of diversions is applicable when:

1. Runoff from higher areas has potential for damaging property, causing erosion, contributing to pollution, flooding, and/or interfering with or preventing the establishment of vegetation on lower areas.

2. Surface and/or shallow subsurface flow is damaging slope upland.

3. The length of slope should be reduced to minimize soil loss.

This standard applies to temporary and permanent diversion structures used in development involving construction and surface-disturbing activities.

Design Criteria

Location

Diversion location shall be determined by considering outlet conditions, topography, land use, soil type, length of slope, seep planes (when seepage is a problem), and the development layout.

Design of Parabolic Grass-Lined Diversions

The peak runoff storm frequency to be used is shown in Table 4.4.1. The channel must be designed for capacity and stability. Capacity must be adequate to carry the peak runoff of the design storm when the grass is tall. The design for maximum permissible velocity shall be based on the height of the plant when mowed. Table 4.4.2 shows the maximum permissible velocity and retardant values for various vegetative covers.

TABLE 4.4.1

Diversion Design Criteria

Diversion Type	Land or Improvement Protected	Storm Frequency[1]	Freeboard	Minimum Top Width
Temporary	Construction areas Building sites	10 years[2]	0.3 foot	4 feet
Permanent	Landscaped, recreation and similar areas	25 years	0.3 foot	4 feet
	Dwellings, schools, commercial buildings, and similar installations	50 years	0.5 foot	4 feet

[1] Use 24-hour storm duration.
[2] Use 10 years or the storm frequency specified by applicable local and state regulatory code

TABLE 4.4.2

Permissible Velocities and Retardant Values for Vegetated and Rock-Lined Waterways

Vegetative Cover Type	Good Stand				Maximum Permissible Velocity V1 (ft/sec)
	For Capacity and V2		For Stability and V1		
	Retardant Value	Plant Height Not Mowed	Retardant Value	Plant Height Mowed	
Bermuda Grass	B	12”	D	2-6”	5
Bahia	C	6-12”	D	2-6”	4
Tall Fescue Grass Mixtures[1]	B	18”	D	6”	4
Sericea Lespedeza Weeping Lovegrass	B	19”	D	2-6”	3

[1] Mixtures of Tall Fescue, Bahia, and/or Bermuda.

NOTE: For planting instructions, refer to “Disturbed Area Stabilization (With Permanent Vegetation).“

This approach provides a channel design having capacity for tall unmowed grass with a velocity V2. The velocity V1, for the mowed height, should not exceed that shown in Table 4.4.2. Professional engineering assistance may be required.

Cross Section

The channel portion of the diversion may be parabolic or trapezoidal. The compacted ridge shall be designed to have stable side slopes, which will not be steeper than 2:1. The ridge shall be minimum width of 4 feet at the design water elevation after settlement. Ten percent should be allowed for settlement.

Channel Dimensions

Diversions should be tailored to fit the conditions of a particular field and local soil type(s). Velocities should be kept as high as will be safe for the planned type of cover and the expected maintenance. Table 4.4.2 may be used as a guide in selecting design velocities.

Land slope must be taken into consideration when choosing channel dimensions. On the steeper slopes, narrow and deep channels may be required. On the more gentle slopes, broad, shallow channels are typically applicable. Wide, shallow channels are easier to maintain.

Size of Channel

After "Q" (the flow), the channel grade and the safe velocity have been calculated, the required size of diversion channel can be determined from established engineering practices.

Outlets

Each diversion must have an adequate outlet. The outlet may be a constructed or natural waterway, a stabilized vegetative area, or a stabilized open channel. In all cases, the outlet must discharge in such a manner as to not cause an erosion problem. Protected outlets shall be constructed and stabilized prior to construction of the diversion.

Stabilization

Channels shall be stabilized in accordance with Item 5 of the construction specifications on page 4.6.

Roads and Utility Rights-of-Way

Diversions installed to divert water from a road or right-of-way shall consist of a series of compacted ridges of soil running diagonally across the road at a 30-degree angle. Ridges are constructed by excavating a channel upstream for this type of diversion.

A detailed design is not required for this type of diversion. The compacted ridge heights shall be 8 to 12 inches above the original road surface. See Figure 4.4.1. Channel bottoms and ridge tops should be smooth enough to be crossed by vehicular traffic. Stable outlets must be provided for each diversion. The maximum recommended spacing between diversions is as follows:

Road Grade (percent)	Distance Between Diversions (feet)
1	400
2	250
5	125
10	80
15	60
20	50

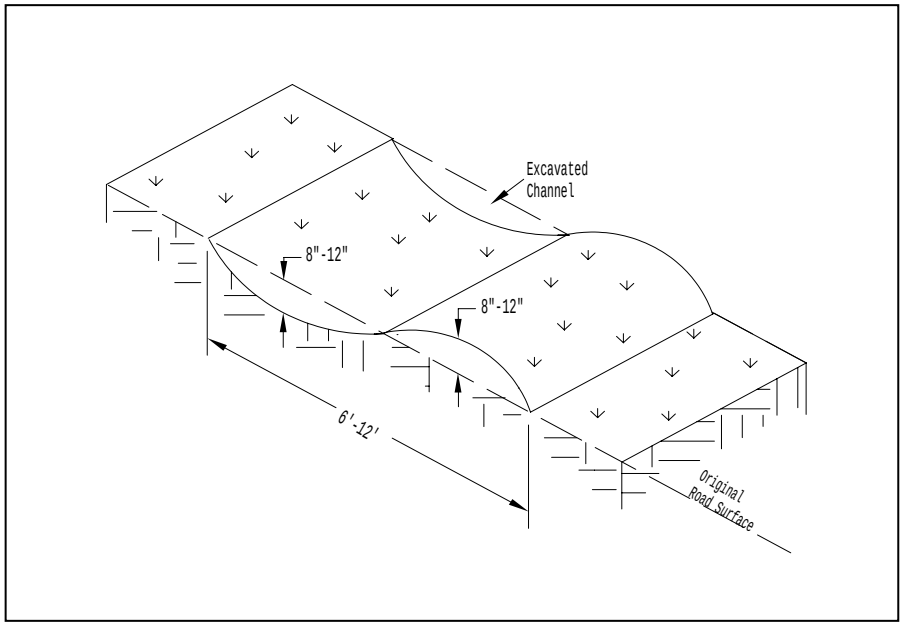

Figure 4.4.1 Typical Diversion Across Road

Construction Specifications

1. Trees, brush, stumps, obstructions, and other objectionable material may be removed and disposed of so as not to interfere with the proper functioning of the diversion.

2. The diversion shall be excavated or shaped to line, grade, and cross section as required to meet the criteria specified herein and free of irregularities that will impede normal flow.

3. When necessary, fills shall be machine-compacted to prevent unequal settlement that would cause damage in the completed diversion.

4. All earth removed and not needed in construction shall be spread or disposed of so that it will not interfere with the functioning of the diversion.

5. Stabilization

    a. Vegetative Protection

        i. The appropriate standard and specification of this manual shall be followed for disturbed area stabilization for time of seeding, sprigging or sodding, liming and fertilizing, and site and seedbed preparation.

        ii. Mulching shall be required for all seeded or sprigged channels and shall be performed at rates shown in “Disturbed Area Stabilization (With Mulching Only).”

        iii. Temporary protection during establishment should be provided when conditions permit the use of temporary diversions or other means to dispose water.

    b. Mechanical Vegetative Protection

        Stone center diversions may be stabilized with riprap in accordance with accepted engineering practices.

    c. Mechanical Protection

        Paving shall be performed in accordance with the Department of Transportation specifications for paved ditches.